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Wu

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(54) **CABLE ASSEMBLY HAVING MOVABLE OPTICAL MODULES**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**
G02B 6/36 (2006.01)
G02B 6/00 (2006.01)

(52) **U.S. Cl.**
USPC **385/93**; 385/147

(58) **Field of Classification Search**
USPC 385/88–95, 147; 439/607.58, 626, 439/607.01
See application file for complete search history.

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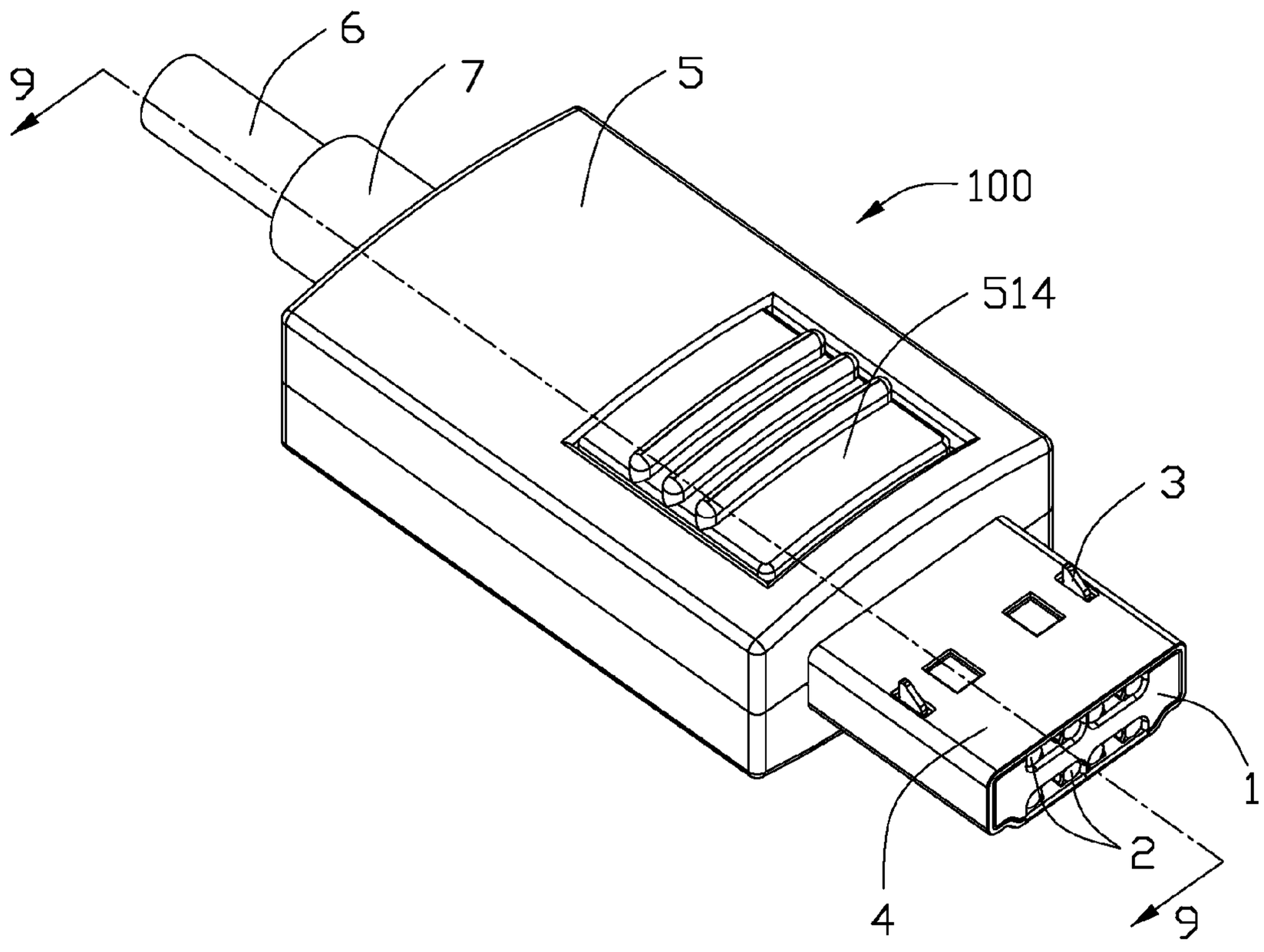
(57) **ABSTRACT**

A cable assembly includes an insulative housing having a main portion, and a mating portion extending forwardly from the mating portion. An optical device is attached to the housing and has a pair of optical module movable accommodated in the mating portion along a front-to-back direction for optical transmitting. The optical modules each has a seat and a number of lenses supported by the seat. The pair of optical modules are adapted for connecting two corresponding connectors, respectively, and a combination of the pair of the optical modules is also adapted for connecting a single corresponding connector.

16 Claims, 9 Drawing Sheets



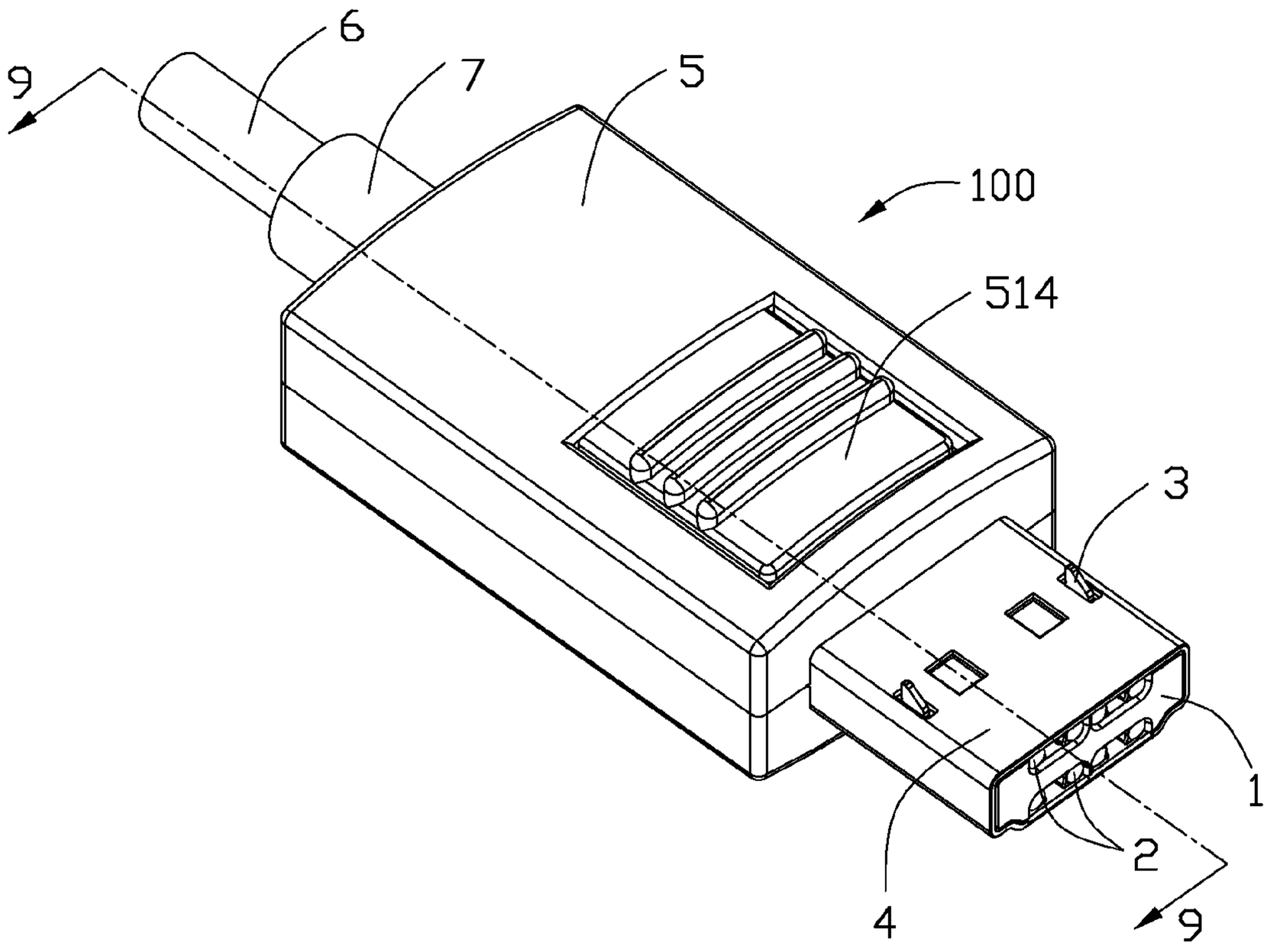


FIG. 1

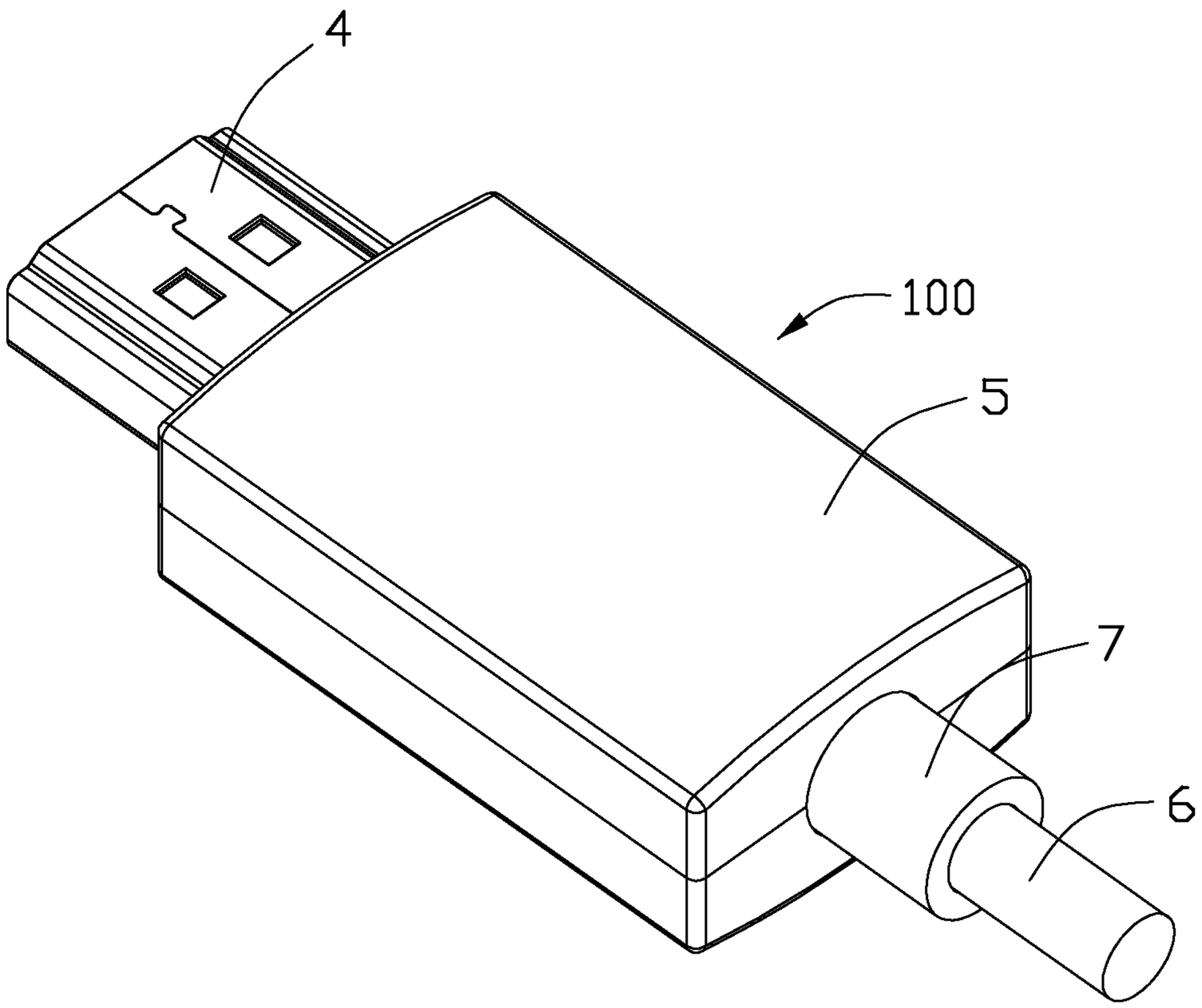
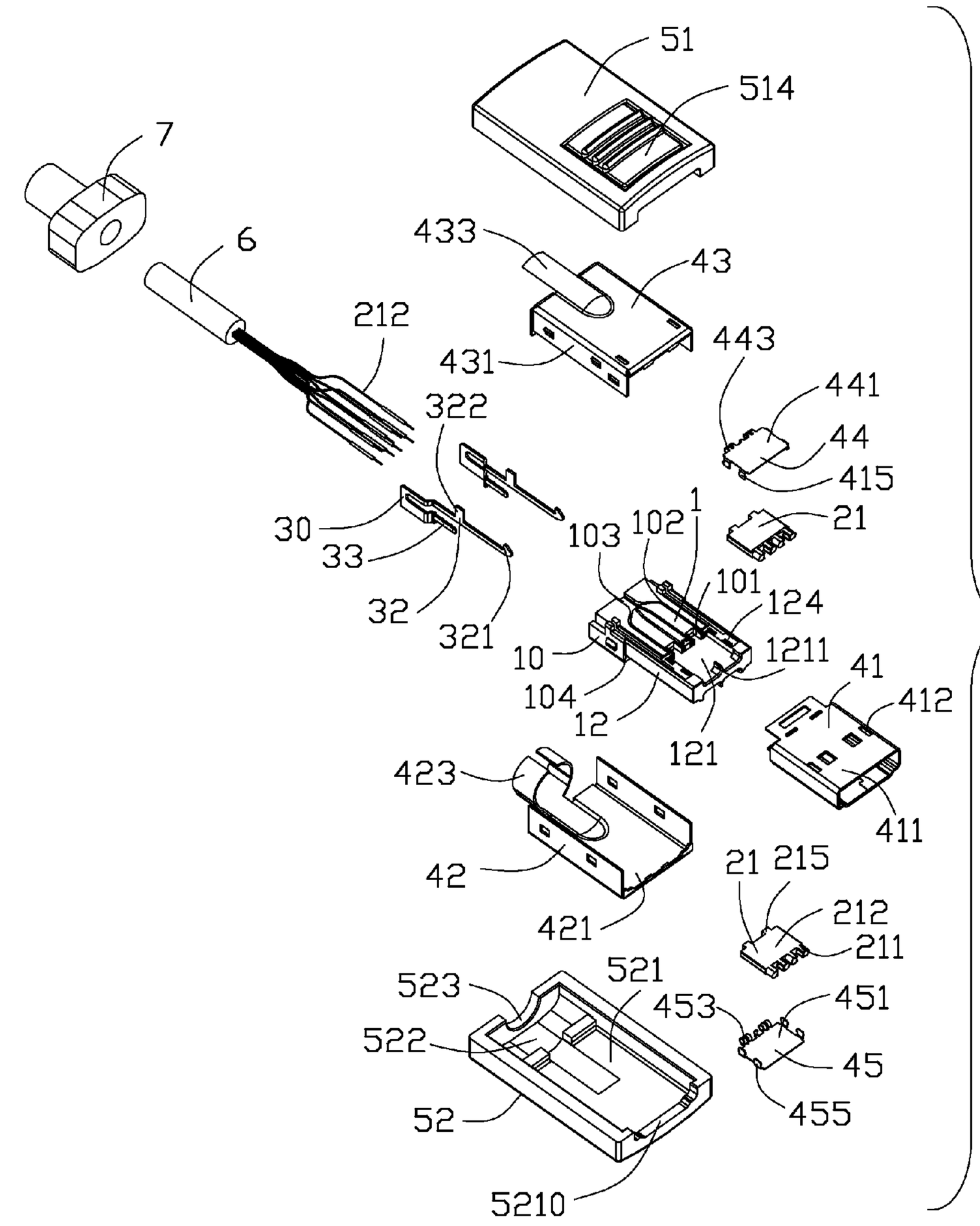


FIG. 2


51
514
7
6
433
43
212
431
443
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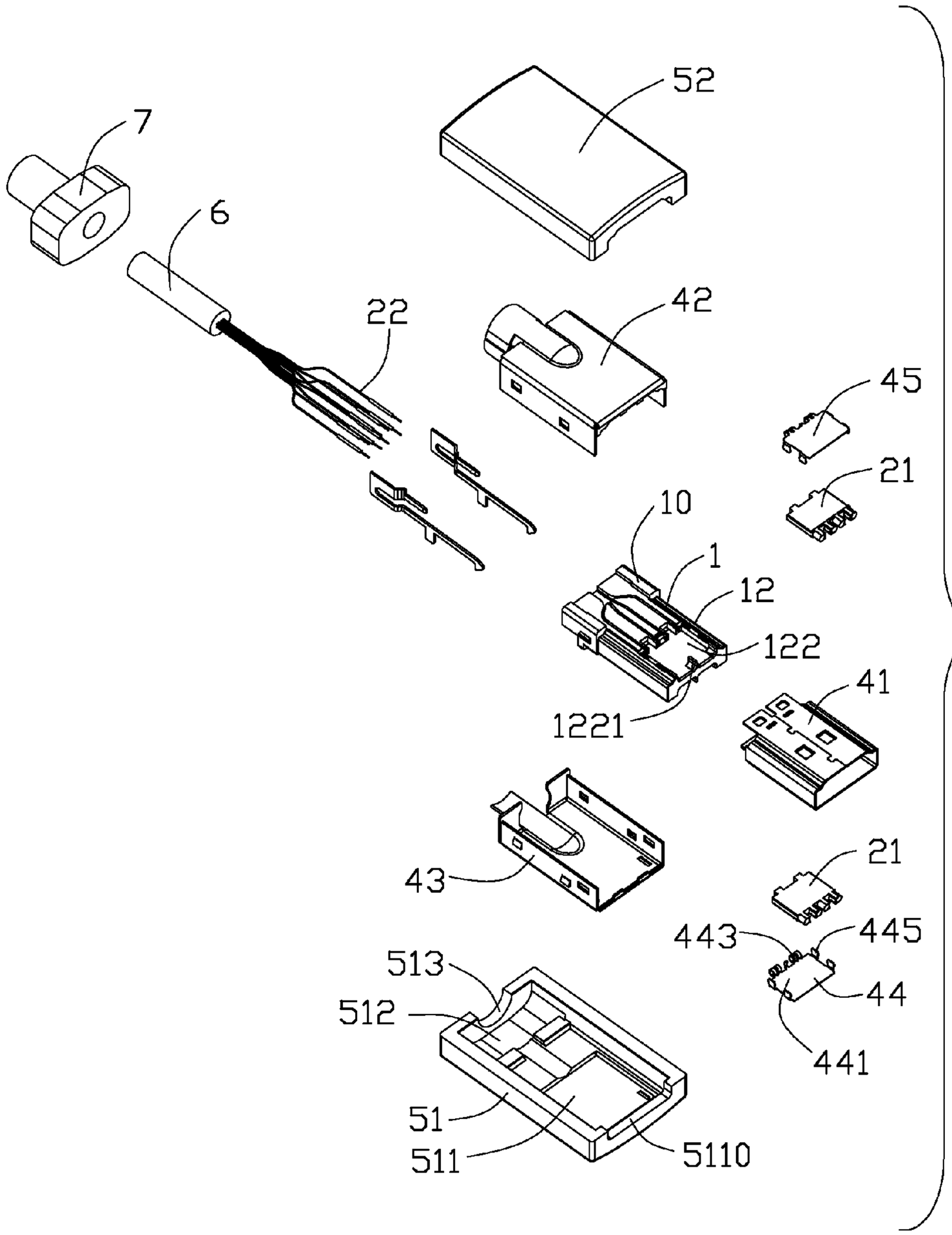
322
44
415
30
33
103
102
1
21
101
124
32
321
10
1211
104
12
121
41
412
423
411
42
21
215
212
421
211
523
521
453
451
522
45
52
455
5210
100

FIG. 3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52
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21
10
1
12
122
1221
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43
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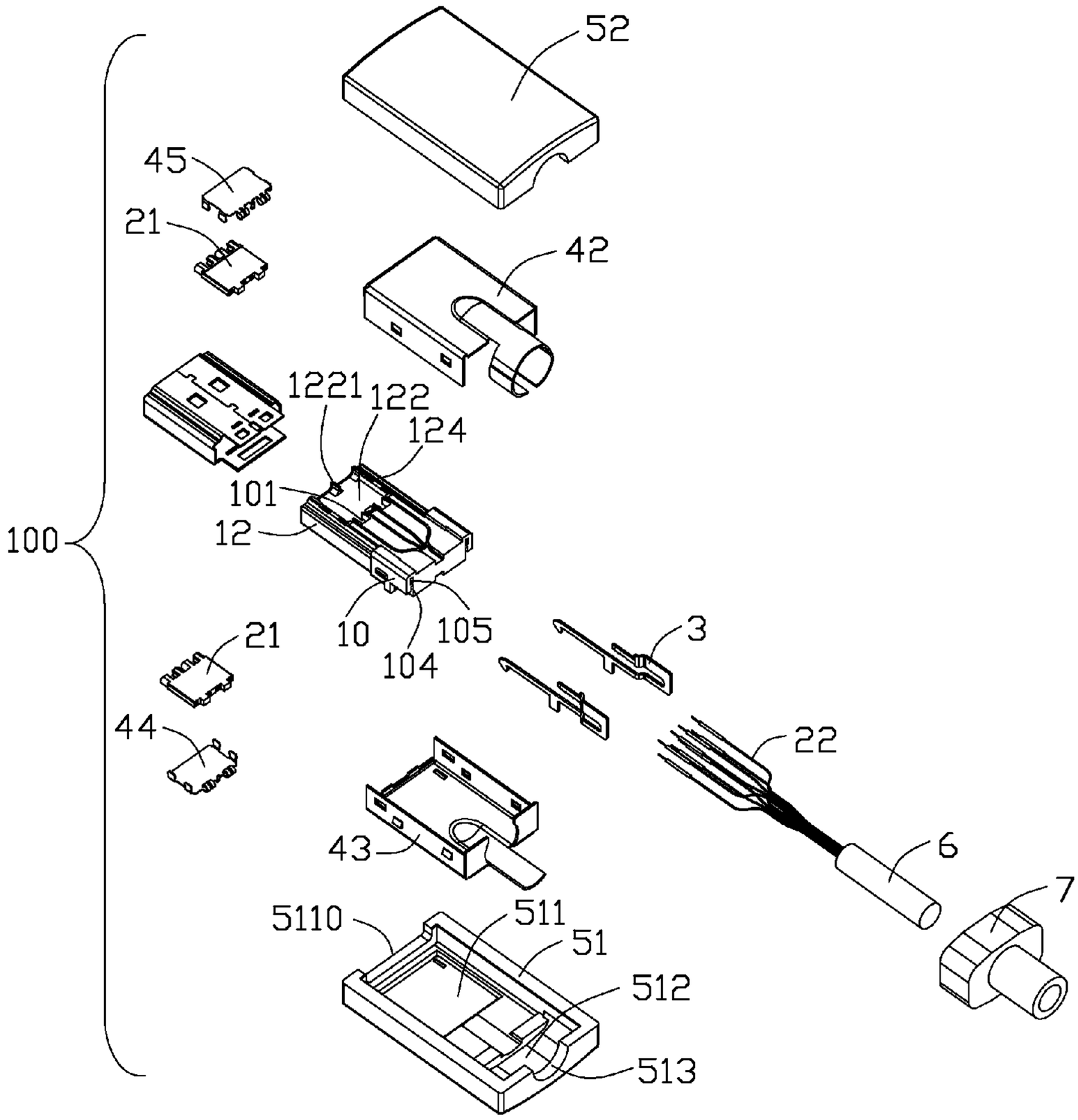
443
445
44
441
513
512
51
511
5110
100

FIG. 4


52
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21
42
1221
122
124
101
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104
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511
51
512
513

FIG. 5

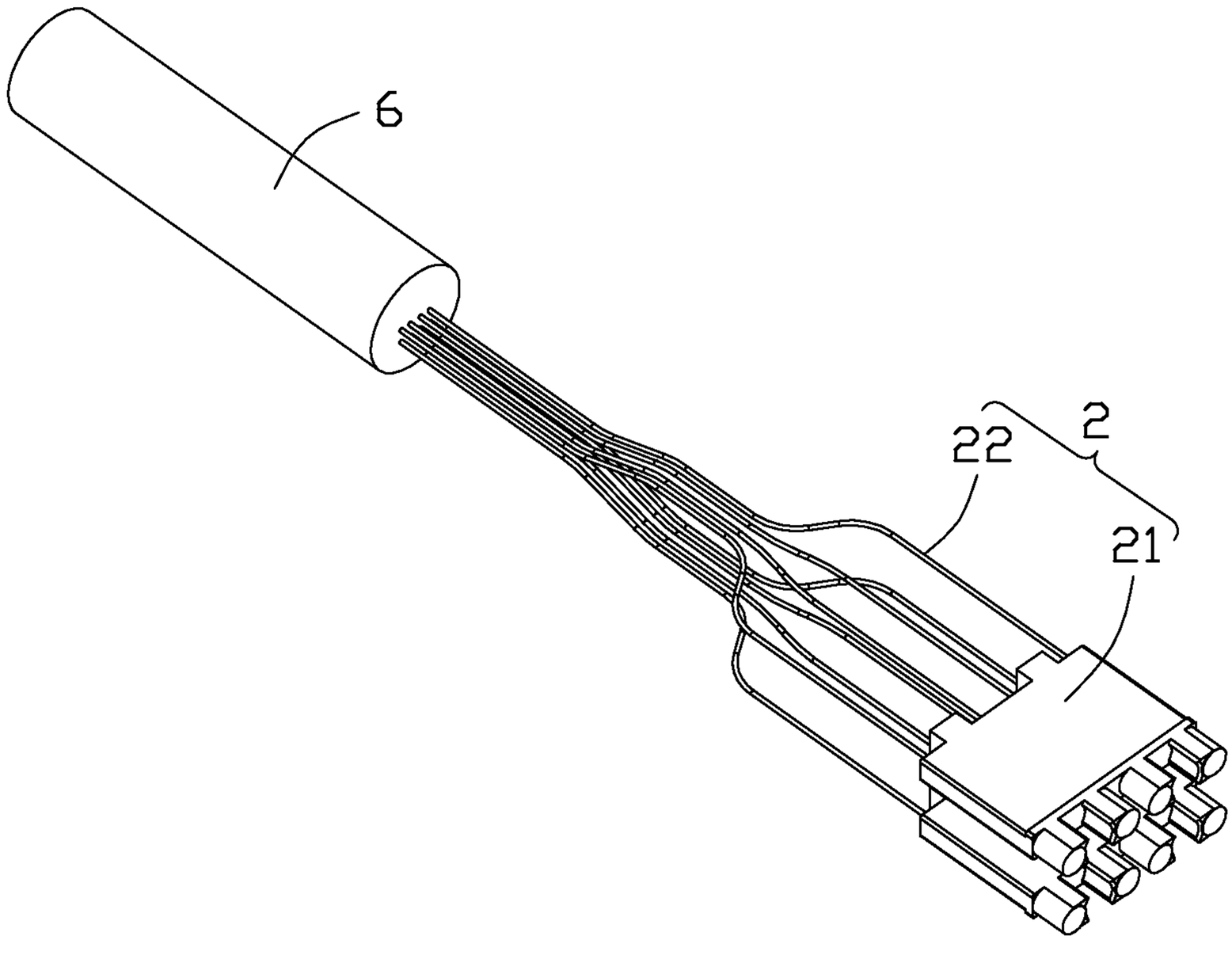

FIG. 6

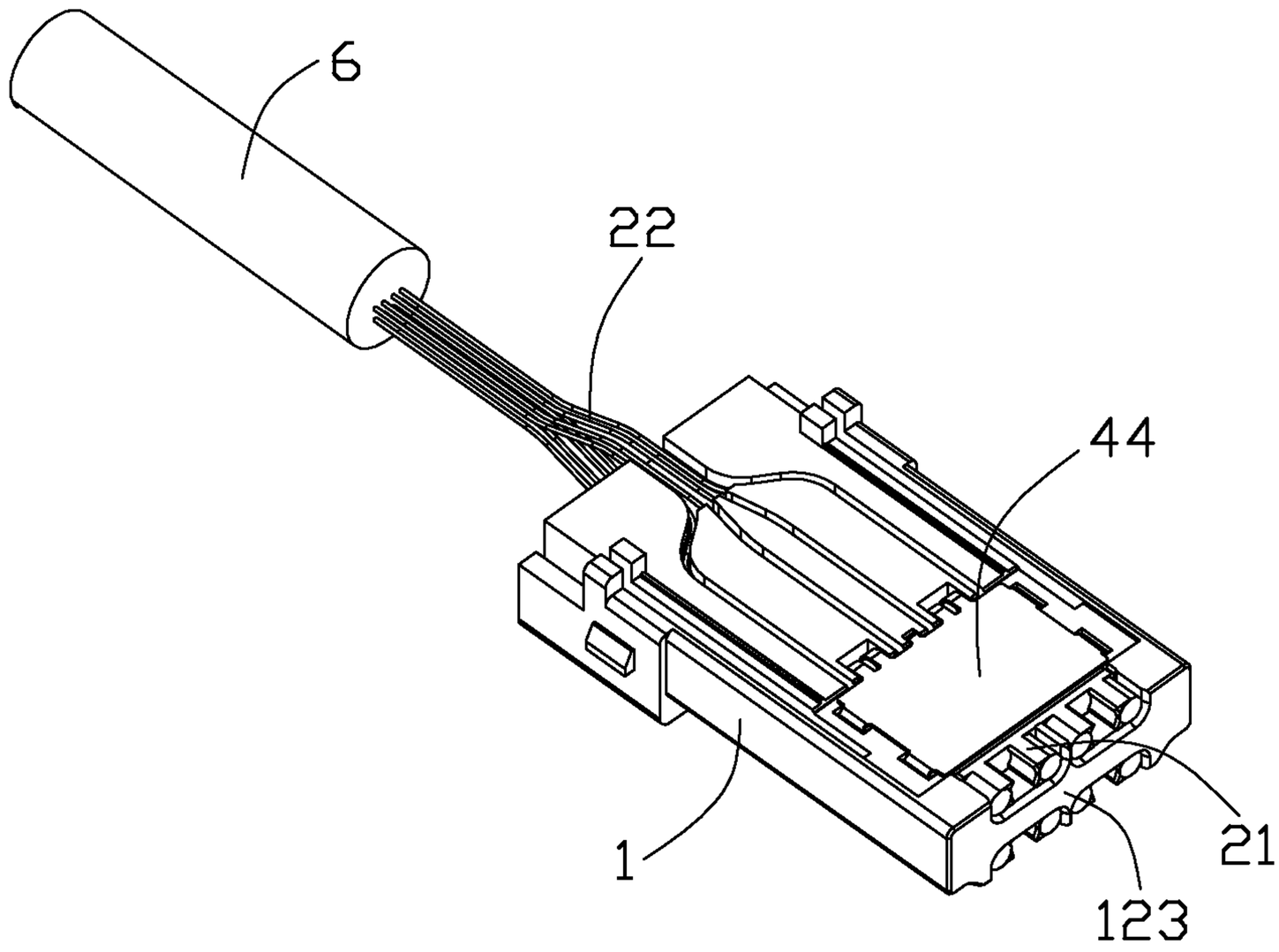

FIG. 7

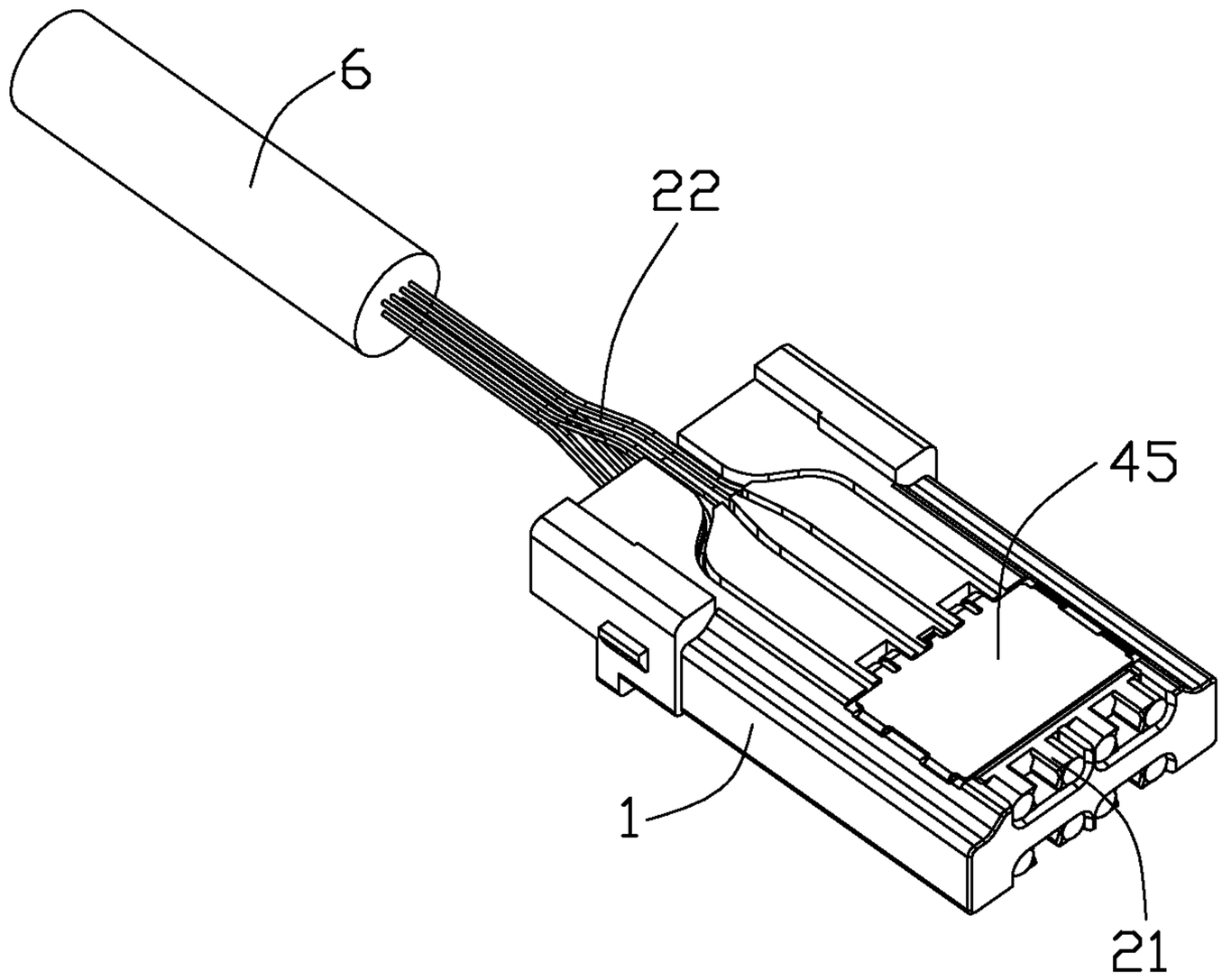

FIG. 8

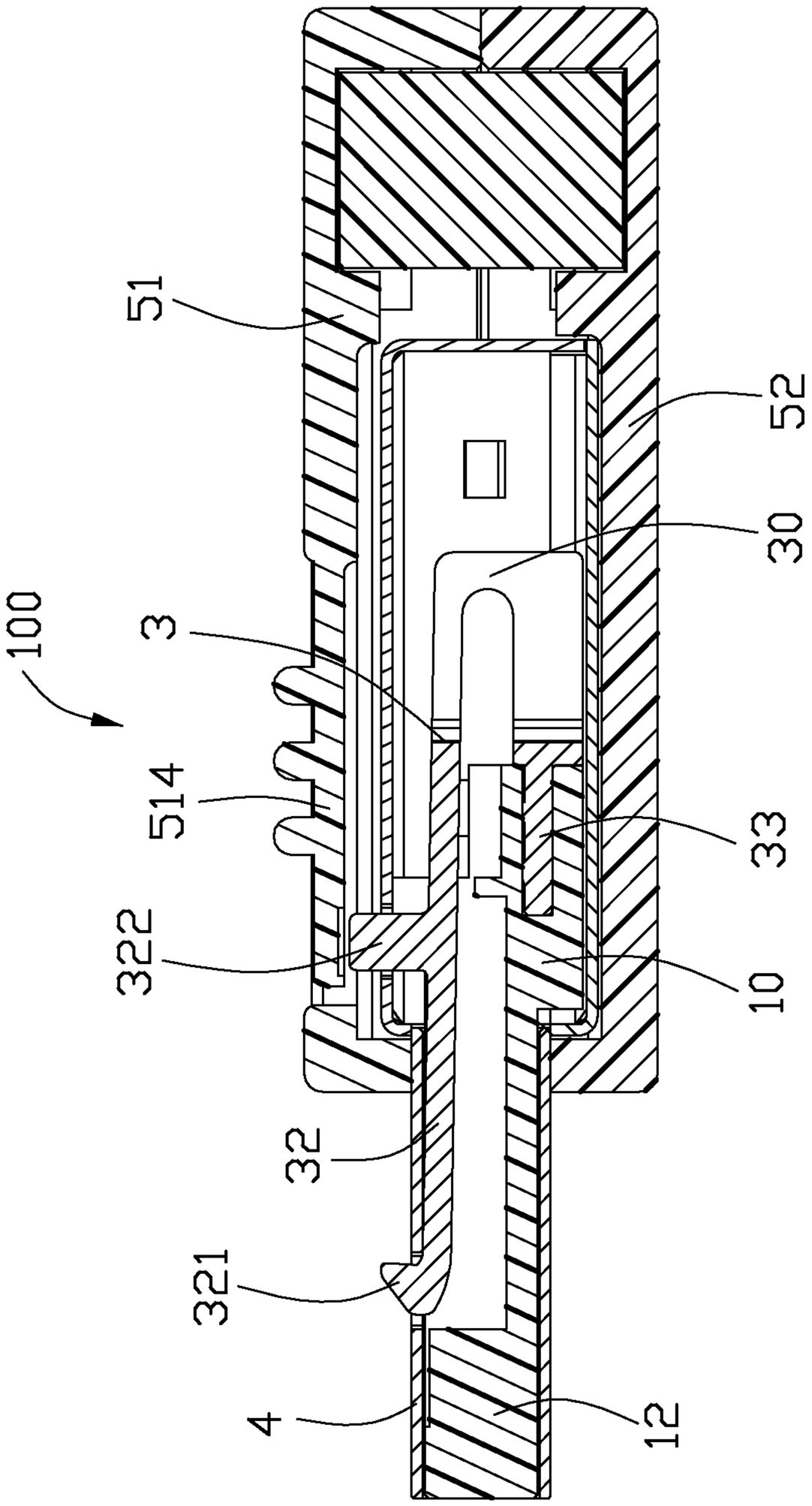

FIG. 9

CABLE ASSEMBLY HAVING MOVABLE OPTICAL MODULES

FIELD OF THE INVENTION

The present invention generally relates to a cable assembly, and more particularly to a cable assembly adapted for optical transmitting.

DESCRIPTION OF PRIOR ART

Nowadays, an electrical device has become lower profile and multi-functional, and a cable assembly for the electrical device is also capable of high-speed transmitting, and reliably connection and easily detachable with its counterpart. Cable assemblies in accordance with USB, SATA, HDMI, SAS and DisplayPort protocol have been widely applied in different kinds of electronic devices. The aforementioned cable assemblies depend on metallic terminals and copper wires to achieve electrical signal transmitting. However, transmitting speed is limited via electrical signal transmitting. In other aspect, as transmitting speed increasing, a structure of the cable assembly becomes complex, and a total dimension of the cable assembly is increasing.

Hence, an improved cable assembly is highly desired to overcome the aforementioned problems.

SUMMARY OF THE INVENTION

According to one aspect of the present invention, a cable assembly, comprises: an insulative housing having a main portion, and a mating portion extending forwardly from the mating portion; an optical device received in the housing, the optical device having a pair of optical modules movable accommodated in the mating portion along a front-to-back direction for optical transmitting, said optical modules each having a seat and a number of lenses supported by the seat; and a cable connected to the lenses and extending backwardly beyond the housing, wherein the pair of optical modules are adapted for connecting two corresponding connectors, respectively, and a combination of the pair of the optical modules are adapted for connecting a single corresponding connector.

According to another aspect of the present invention, a cable assembly, comprises: an insulative housing defining an upper depression, and a lower depression spaced away from the upper depression, both of the upper and the lower depressions extending forwardly through the housing; a pair of optical modules respectively movably retained in the upper and the lower depressions in a mating direction of the cable assembly in condition that the pair of optical module are without interfering with each other, each of the pair the optical modules having a seat, at least one lens mounted into the seat, and at least one fiber coupled to the lens and extending backwardly beyond the housing; and a cable located behind the housing and connected to the fiber.

Other objects, advantages and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an assembled, perspective view of a cable assembly in accordance with the present invention;

FIG. **2** is similar to FIG. **1**, but viewed from another aspect;

FIG. **3** is an exploded, perspective view of a cable assembly in accordance with the present invention;

FIG. **4** is similar to FIG. **3**, but viewed from a first aspect;

FIG. **5** is similar to FIG. **3**, but viewed from a second aspect;

FIG. **6** is a partially assembled view of optical modules connecting with a cable of the cable assembly;

FIG. **7** is a partially assembled view of the optical modules accommodated in an insulative housing of the cable assembly;

FIG. **8** is similar to FIG. **7**, but viewed from other direction; and

FIG. **9** is a cross-section view taken along line **9-9** of FIG. **1**.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Reference will now be made in detail to the preferred embodiment of the present invention.

Referring to FIGS. **1-2**, a cable assembly **100** in accordance with the present invention comprises an insulative housing **1**, an optical device **2** movable retained in the housing **1** for optical transmitting, a pair of metallic latching members **3** retained in the housing **1**, a metallic shell **4**, an external cover **5**, a cable **6**, and a strain relief **7**.

Referring to FIGS. **3-9**, the insulative housing **1** includes a main portion **10** and a mating portion **12** extending forwardly from the main portion **10** for being inserted into a corresponding connector (not shown). The mating portion **12** has an upper depression **121** formed in a top surface, a lower depression **122** formed in a bottom surface, and a mating tongue **123** disposed between the upper and the lower depression **121**, **122** along an upper-to-lower direction of the cable assembly **100**. The upper depression **121** is configured with U-shaped viewed from a front side, and the lower depression **122** is configured with reverse U-shaped viewed from the front side. The upper and the lower depressions **121**, **122** extend forwardly through the mating portion **12** respectively. The mating portion **12** further has a pair of supporting blocks **1211**, **1221** disposed in front ends of the depressions **121**, **122**. A pair of side walls surround around the depressions **121**, **122** and each has a securing slot **124**. The main portion **10** has a pair of positioning slots **101** extending rearwardly from the upper depression **121**, and another pair of positioning slots **101** extending rearwardly from the lower depression **122**. A top and a bottom of the main portion **10** each has four channels **102** communicated with the depressions **121**, **122**, and a locating slot **103** extending rearwardly therethrough from the channels **102**. The top of the main portion **10** has a pair of receiving slots **104** located two outside of the channels **102**. A rear end of the main portion **10** has a retaining hole **105** disposed on two lateral sides thereof and under the receiving slots **104**.

The optical device **2** includes a pair of optical modules **2** isolated away from each other in the upper-to-lower direction, a plurality of fibers **22** connecting the pair of optical modules **2** and the cables **6**. Each of the pair of optical modules **2** includes a number of lenses **211** aligned along a transverse direction perpendicular to the upper-to-lower direction, and a plastic seat **212** supporting the lenses **211**. The fibers **22** are respectively coupled to the lenses **211**. In addition, the lenses **211** extend beyond front side of the seat **212**, with a gap formed between front potions of every two adjacent lenses **211**. The seat **212** has a pair of positioning posts **215** protruding rearwardly thereof.

Each of the latching members **3** includes a connecting arm **30**, a latching arm **32** and a retention arm **33**. The latching arm **32** and the retention arm **33** are spaced apart from each other in the upper-to-lower direction and extend forwardly from the connecting arm **30**. The latching arm **32** and the retention arm **33** are located in a first vertical plane. The connecting arm **30** is of U-shaped and located in second vertical plane which is disposed outside the first vertical plane. The latching arm **32** has a hook **321** formed on a front end, a tab **322** formed on a top side thereof and disposed behind the hook **321**. The hook **321** protrudes upwardly beyond the mating portion **12**. The tab **322** protrudes upwardly beyond the main portion **10** for lathing with the corresponding connector. The retention arm **33** is inserted into the retaining hole **105** of the housing **1**, and the latching arm **32** is retained in the receiving slot **104** of the housing **1**.

The metallic shell **4** has a first shell **41**, a second shell **42**, a third shell **43**, an upper cap **44**, and a lower cap **45**. The first shell **41** includes a frame **411** to accommodate the mating portion **12** therein. The second shell **42** includes a U-shaped main body **421** and a cable holder **423** integrated with the main body **421** and projecting backwardly. The third shell **43** includes an inverted U-shaped main portion **431** and a tail **433** extending rearwardly. The second shell **42** and the third shell **43** are combined together in the upper-to-lower direction.

The upper and the lower caps **44**, **45** are symmetrical with each other in the upper-to-lower direction. The upper cap **44** includes a planar body **441** directly covering one optical module **21**, a pair of cylindrical shaped first retainers **443** formed at a rear end thereof, and a plurality of second retainers **445** formed at opposite sides of the planar body **441**. The lower cap **45** includes a planar body **451** directly covering the other optical module **21**, a pair of cylindrical shaped first retainers **453** formed at a rear end thereof, and a plurality of second retainers **455** formed at opposite sides of the planar body **451**.

The external cover **5** includes an upper cover **51** and a bottom cover **52**. The upper cover **51** has a first hollow **511**, a second hollow **512** disposed behind the first hollow **511**, and a rectangular shaped opening **5110** located in a front portion thereof. The opening **5110** communicates with the first hollow **511**. A semicircular shaped outlet **513** is defined in a rear portion of the upper cover **51** and communicated with the second hollow **512**. A deformable button **514** is integrally formed with the upper cover **51** and floatable along the upper-to-lower direction to enter the first hollow **511** so as to actuate the tab **322** of the latching arm **32**. When detach the cable assembly **100** from the corresponding connector, just press the deformable button **514** to actuate the tab **324** of the latching arm **32**, and the latching arm **32** retreat into the receiving slots **104**. When the pressing force is withdrawn, the deformable button **514** is restored to its original position, and the latching arms **32** also upwardly move by rebounded force.

The bottom cover **52** is similar to the upper cover **51**, and also has a first hollow **521** and a second hollow **522** disposed behind the first hollow **521**. An opening **5210** is located in a front portion of the bottom cover **52** and communicates with the first hollow **521**. A semicircular shaped outlet **523** is defined in a rear portion of the bottom cover **52** and communicates with the second hollow **522**.

The strain relief member **7** is molded over a front segment of the cable **6** and accommodated in the second hollows **512**, **522**.

The pair of optical modules **21** are assembled to the upper and the lower depressions **121**, **122** of the insulative housing **1**, respectively, and the lenses **211** are disposed to exterior for mating with the corresponding connector. the positioning posts **215** of the optical modules **21** are rearwardly received in the positioning slots **101** of the housing **1**. The seats **212** of the optical modules **21** press onto the supporting block **1211**, **1221** to be stopped by the supporting block **1211**, **1221**, respectively. The upper and the lower caps **44**, **45** are assembled to the mating portion **12** of the housing **1** and covers the optical modules **21**, respectively. The first retainers **443**, **453** are received in the positioning slots **101** to be sandwiched between inner walls of the positioning slots **101** and the positioning posts **215** in a front-to-back direction for the optical modules **21** can move in the front-to-back direction. The second retainers **445**, **455** are inserted in the securing slots **124** of the mating portion **12**. The fibers **21** rearwardly pass through the channels **102** and the locating slots **103** in turn and connect with the cable **6**. The pair of optical modules **21** could being adapted for connecting two corresponding connectors, respectively, and a combination of the pair of optical modules **21** could being adapted for connecting a single corresponding connector.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.

What is claimed is:

1. A cable assembly, comprising:

an insulative housing having a main portion, and a mating portion extending forwardly from the mating portion;

an optical device received the housing, the optical device having a pair of optical modules movable accommodated in the mating portion along a front-to-back direction for optical transmitting, said optical modules each having a seat and a number of lenses supported by the seat; and

a cable connected to the lenses and extending backwardly beyond the housing;

wherein the pair of optical modules are adapted for connecting two corresponding connectors, respectively, and a combination of the pair of the optical modules are adapted for connecting a single corresponding connector;

wherein the mating portion includes an upper depression, a lower depression opposited to the upper depression, and a mating tongue located between the upper and the lower depressions, the upper and the lower depressions extend forwardly through the mating portion, the pair of optical modules are capable of sliding along the upper and the lower depressions, respectively.

2. The cable assembly as recited in claim **1**, wherein the lenses are arranged in a row along a transversal direction and embedded in the seat, the pair of optical modules are isolated away from each other by the housing.

3. The cable assembly as recited in claim **1**, wherein the upper depression is configured with U-shaped from a front side, and the lower depression is configured with reverse U-shaped from the front side.

4. The cable assembly as recited in claim **1**, further comprising a metallic upper cap and a metallic lower cap, both of which are retained on the mating portion to directly cover the optical modules, respectively.

5. The cable assembly as recited in claim **4**, wherein the main portion has a plurality of positioning slots communicating with the upper and the lower depressions, and the optical modules include positioning posts backwardly received in the positioning slots, each of the upper and the lower caps has a planar body covers the optical module, and a cylindrical

shaped first retainers sandwiched between the positioning post and an inner wall of the positioning slot.

6. The cable assembly as recited in claim **5**, wherein the mating portion has a pair of supporting blocks disposed at front portions of the upper and the lower depressions, respectively, and the seat of the optical modules are stopped by the supporting block for being prevented from sliding away from the mating portion.

7. A cable assembly, comprising:

an insulative housing defining an upper depression, and a lower depression spaced away from the upper depression, both of the upper and the lower depressions extending forwardly through the housing;

a pair of optical modules respectively movably retained in the upper and the lower depressions in a mating direction of the cable assembly in condition that the pair of optical module are without interfering with each other, each of the pair the optical modules having a seat, at least one lens mounted into the seat, and at least one fiber coupled to the lens and extending backwardly beyond the housing; and

a cable located behind the housing and connected to the fiber;

further comprising a metallic upper cap and a metallic lower cap, both of which are retained on the mating portion to directly cover the optical modules, respectively;

wherein the housing includes a main portion, and a mating portion extending forwardly from the main portion and holding the pair of optical modules for being inserted into a corresponding connector, the upper and the lower caps are retained on the mating portion.

8. The cable assembly as recited in claim **7**, wherein the upper depression is configured with U-shaped from a front side, and the lower depression is configured with reverse U-shaped from the front side, the housing has a mating tongue portion disposed between the upper and the lower depression in an upper-to-lower direction.

9. The cable assembly as recited in claim **7**, wherein the housing has a plurality of positioning slots backwardly extending from the upper and the lower depressions, the optical modules include positioning posts backwardly received in the positioning slots, each of the upper and the lower caps has a planar body covers the optical module, and a cylindrical shaped first retainers sandwiched between the positioning post and an inner wall of the positioning slot.

10. The cable assembly as recited in claim **7**, further comprising a metallic shell, and a pair of latching members attached to the housing and located at two lateral sides of the optical modules, the shell has a frame surrounding around the mating portion and the upper and the lower caps, each of the pair of latching members has a latching arm delectable in an upper-to-lower direction, a tab protruding upwardly to abut against with a deformable button, and a hook protruding upwardly beyond the shell for locking with the corresponding connector and disposed at a front of the tab.

11. A cable connector assembly comprising:

a housing defining a pair of opposite receiving cavities spaced, via a partition wall, from each other in a transverse direction perpendicular to a lengthwise direction wherein a dimension of the housing in the transverse direction is much shorter than that in the lengthwise direction;

a pair of optical modules disposed in the corresponding receiving cavities, respectively and independently back and forth moveable therein along a front-to-back direction perpendicular to both said transverse direction and said lengthwise direction;

two sets of grooves formed in the housing and spaced from each other in a transverse direction to receive two sets of optical fibers which optically couple to the corresponding optical modules, respectively; and

an external cover encloses the housing and said two sets of optical fibers; wherein

a front end of each optical module is forwardly exposed to an exterior in said front-to-back direction.

12. The cable connector assembly as claimed in claim **11**, wherein said two sets of optical fibers are integrated in a cable extending rearwardly from a rear end of the cover.

13. The cable connector assembly as claimed in claim **11**, further including a metallic shell enclosing a front portion of the housing to shield the pair of receiving cavity and the corresponding optical modules therein in the transverse direction.

14. The cable connector assembly as claimed in claim **13**, wherein said shell defines a pair of chamfer like structures on around opposite two ends of the shell in said lengthwise direction.

15. The cable connector assembly as claimed in claim **13**, further including a pair of caps each retained to the housing and sandwiched between the shell and the corresponding optical module to hold the corresponding optical module in position.

16. The cable connector assembly as claimed in claim **13**, further including a pair of metallic shells commonly sandwiching the housing therebetween, and respectively sandwiched between the housing and the cover.

* * * * *